Annual Industrial Capabilities Report

to

Congress

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1. Annual Report Requirements

Section 2504 of title 10, United States Code, requires the Secretary of Defense to submit an annual report to the Committee on Armed Services of the Senate and the Committee on National Security of the House of Representatives, by March 1st of each year. The report is to include descriptions of:

- Department of Defense (DoD) industrial and technological guidance issued to facilitate the attainment of national security objectives, including that guidance providing for the integration of industrial and technological capabilities considerations into its budget allocation, weapons acquisition, and logistics support decision processes.

- Methods and analyses undertaken by the DoD alone or in cooperation with other Federal agencies, to identify and address industrial and technological capabilities concerns.

- Industrial and technological capabilities assessments prepared pursuant to section 2505 of title 10, United States Code, and other analyses used in developing the DoD's budget submission for the next fiscal year, including a determination as to whether identified instances of foreign dependency adversely impact warfighting superiority.

- DoD programs and actions designed to sustain specific essential technological and industrial capabilities.

This report contains the required information.

2. Overview

This report describes relevant internal policy guidance, the analyses used to identify industrial capabilities issues, and each action taken to address specific essential industrial and technological capabilities. It also describes related activities to improve defense-critical industrial and technological capabilities.

DoD Policy Guidance

DoD did not issue new Department-wide industrial capabilities-related policy guidance in 1998. Rather, it focused instead on executing guidance already issued. The Department has taken the steps necessary to identify and address potential industrial capabilities problems wherever they occur – including the subtiers – within its regular budget, acquisition, and logistics processes. It also is giving strong support to the antitrust agencies in their reviews of mergers and acquisitions and taking action to develop and execute acquisition strategies that promote competitive choices for key weapon systems.

Although the Department did not issue new "corporate" policy guidance in 1998, the Army issued in June 1998 an industrial base policy letter specifying the strategy it would employ to improve the efficiency of its ammunition procurement programs.

DoD Assessments, Decisions, and Actions

In 1998, the Department and its Components continued to conduct assessments to identify and evaluate those industrial and technological capabilities needed to meet current and future defense requirements. The Department then used the results of these assessments to make informed budget, acquisition, and logistics decisions.

"DoD-wide" industrial assessments evaluated and addressed changes in key component and material providers that supply many programs, and affect competition, innovation, and product availability. In selected DoD-wide assessments, the Department specifically considered the extent to which vertical integration within a consolidated defense industry might adversely affect competition and innovation. (Major firms that build defense weapon systems have acquired the capabilities to produce primary subsystems and components that go into those platforms. Firms can use these internal "vertical" capabilities to their advantage – without consideration for, or despite the superiority of, the capabilities of outside sources.)

Additionally, DoD Components (the Army, Navy, Air Force, and Defense Logistics Agency) conducted their own industrial assessments when there was an indication that industrial or technological capabilities associated with an industrial sector, subsector, or commodity important to a single DoD Component could be lost; or it was necessary to provide industrial capabilities information to help make specific programmatic decisions.

The DoD-wide and DoD Component industrial assessments generally led to similar conclusions:

- Although the defense industry has experienced significant reductions and downsizing, DoD found very few cases where essential capabilities are endangered, even given low production rates.

- Despite significant restructuring and consolidation within the defense industry, two or more contractors with design and manufacturing experience remain to compete for major defense programs within each product sector.

DoD has taken action to preserve selected capabilities for which DoD peacetime requirements are limited, and projected military contingency requirements are significantly larger (for example, for critical troop support items such as nerve agent antidotes in autoinjectors). In such cases, DoD has restricted competition in a solicitation, for mobilization base reasons, to domestic sources and/or acquired and maintained facilities, equipment, or components needed to meet projected military contingency (surge and replenishment) requirements.

Related Industrial and Technological Capabilities Activities

In addition to performing industrial capabilities analyses, the Department has established programs to develop or improve defense-critical industrial and technological capabilities; and to identify, adapt and leverage predominantly commercial and dual use capabilities and products for defense applications:

- DoD uses the authorities of *Title III of the Defense Production Act* to provide domestic firms with a variety of financial incentives to establish, modernize, or expand domestic production capability and capacity for technology items, components, and industrial resources essential for national defense.

- Within the *Dual Use Science & Technology Program*, DoD jointly funds research projects with industry that develop dual use technology solutions for DoD problems.

- *DoD's Manufacturing Technology Program* supports the implementation of defense-critical manufacturing processes to improve affordability and facilitate the ultimate success of weapon system programs.

- DoD uses its *Technology Transfer Program* to monitor DoD research and development activities, identify those technological advances that have potential for non-defense commercial applications, and facilitate the transfer of such technological advances to the private sector.

- DoD's *Commercial Operations and Support Savings Initiative* adapts and inserts commercial items into fielded defense systems to reduce operations and support costs.

Finally, the Department has employed *Executive Agents and Working Groups* to better monitor industrial issues associated with custom components (non-commercial items or subsystems) used in multiple defense applications. (Generally, development and procurement of such components are decentralized.) In particular, DoD has:

- Designated the Navy as its executive agent for microwave power tubes to: (1) identify and maintain consolidated DoD microwave power tube acquisition requirements and research and development plans; (2) monitor the major domestic microwave power tube manufacturers and key component and material suppliers; and (3) facilitate coordination among the Services and Defense Agencies, and among DoD and other U.S. Government Agencies that use microwave power tubes.

- Chartered working groups reporting to the Director, Defense Research and Engineering to oversee implementation of DoD efforts to develop and fund a radiation hardened microcircuit investment strategy focusing technology and new product development activities.

Collectively, these programs: (1) reduce defense program costs; (2) accelerate the insertion of advanced technologies into defense systems; and (3) strengthen the production and technological capabilities of key industrial sectors on which DoD depends.

3. DoD Policy Guidance

3.1 Corporate Guidance

In its 1997 and 1998 annual industrial capabilities reports to Congress, the Department reported that it had established policies and procedures necessary to meet its responsibilities to maintain a capable, competitive, and innovative industrial base. DoD did not issue new Department-wide industrial capabilities-related policy guidance in 1998. It focused instead on executing guidance already issued. The Department has taken the steps necessary to identify and address potential industrial capabilities problems wherever they occur – including the subtiers – within its regular budget, acquisition, and logistics processes. It also is giving strong support to the antitrust agencies in their reviews of mergers and acquisitions and taking action to develop and execute acquisition strategies that promote competitive choices for key weapon systems. Finally, the Department is increasing its visibility into subtier developments.

The Quadrennial Defense Review highlighted the three strategic challenges facing the Department of Defense. DoD must seek to shape the international environment, respond to the full spectrum of crises that threaten U.S. interests, and prepare now for an uncertain future. To meet these challenges and support the required revolution in military affairs, DoD must be able to draw on a supplier base that can design and produce next generation weapons, innovate to preserve technological leadership, reduce cycle times to respond to evolving threats, lower costs significantly, and support interoperability for joint and coalition warfare with our allies.

To meet mission requirements cost-effectively, the Department wants to rely increasingly on the broader commercial world. The Department is continuing to break down barriers between the commercial and defense industries to realize the benefits of civil-military integration in both research and development and manufacturing, to increase the pace of innovation in defense systems, and to reduce the cost of such systems. The Department has identified the barriers that it believes collectively account for the quantifiable cost premium between the commercial and military industrial structures and is taking steps to mitigate or eliminate the impact of those barriers.

The Department also recognizes it must leverage the resources of a reshaped defense industry. In real terms, DoD acquisition budgets (research, development, test and evaluation, and procurement) have been reduced by more than 60 percent since 1985, the peak year of the most recent military build-up. Between 1990 and 1998, acquisition budgets declined in 9 of 12 major product sectors; in 8 of those sectors, acquisition budgets declined by more than 40 percent. In response, defense firms initiated a series of actions to restructure their operations. They reduced excess infrastructure and workforce levels to better match reduced demand, streamlined processes, and revamped supplier relationships. In addition, they began a process of industry consolidation via mergers and acquisitions.

Selected U.S. Defense Product Sectors – Contractor Changes (1990-1998)			
Product Sector	% Budget Change[1]	Companies (1990) [2]	Companies (1998) [2]
Ammunition[3]	-56	9	9
ELVs[4]	-38	6	3
Fixed-wing	-59	8	3
Rotorcraft	-60	4	3
Satellites	65	8	6
Strategic Missiles	-68	3	2
Submarines	2	2	2
Surface Ships	-62	8	5
Tactical Missiles	-54	13	4
TWVs[5]	40	6	3
Torpedoes	-89	3	2
TCVs[6]	-53	3	2

[1] "% Budget Change" is based on constant FY 1998 dollars.
[2] Companies producing products in stated year. Not all companies produce all classes of products within a given sector. For example, five major shipbuilders produce Navy surface ships; but only three have produced the more complex Navy warships (surface combatants) within the past ten years.
[3] The number of munitions companies reflects government-owned assembly and explosive production facilities. There were 32 in 1978 and 17 in 1987.
[4] Expendable Launch Vehicles
[5] Tactical Wheeled Vehicles
[6] Tracked Combat Vehicles

Despite significant restructuring and consolidation within the defense industry, at least two contractors with design and manufacturing experience remain to compete for major defense programs within each major product sector. (Additionally, other firms, not currently producing products within a given sector, although not reflected in the table, may have the *capability* to produce such products.) In those cases where the Department expects a limited number of prime contractors, it is taking appropriate steps to ensure there will be effective competition for future major defense systems.

Overall, the restructuring of the defense industry has been successful. Mergers and acquisitions have helped consolidate the industry. There have been no significant bankruptcies or bail outs of defense firms. Competition for defense products remains. And DoD is saving money. For example, for the nine restructurings for which it audited cost data, DoD expects to accrue net savings after restructuring costs of over $3.4 billion.

3.2 Army Industrial Base Policy on Ammunition

As reported in last year's Annual Industrial Capabilities Report to Congress, the Army considered new strategies to configure and manage the U.S. munitions industrial base. In June 1998, the Army issued an industrial base policy letter specifying the strategy with which it planned to improve the efficiency of its ammunition procurement programs. There are four elements to the new strategy: (1) manage ammunition using DoD's life-cycle acquisition process; (2) use acquisition reform initiatives to stabilize the business environment and provide incentives for private investment in the production base; (3) rely on the private sector to create and sustain ammunition production assets in response to production and replenishment contracts; and (4) to the maximum extent feasible, transition government-owned ammunition production assets to the private sector while preserving the ability to conduct explosives handling operations safely.

4. DoD-Wide Assessments, Decisions, and Actions

4.1 Introduction

The Department periodically conducts assessments to identify and evaluate those industrial and technological capabilities needed to meet current and future defense requirements. It then uses the results of these assessments to make informed budget, acquisition, and logistics decisions. In 1998, the Department conducted both *industrial* assessments and *domestic source restriction* assessments.

Industrial assessments are conducted to profile industrial or technological capabilities associated with an industrial sector, subsector, or commodity important to DoD. In such assessments, the Department determines the: (1) key capabilities required for a particular product; (2) potential suppliers that possess those capabilities; and (3) extent to which demand estimates might influence the continued availability of those capabilities. Recently, DoD industrial assessments also began to consider the extent to which vertical integration within a consolidated defense industry might adversely affect competition and innovation. (Major firms that build defense weapon systems have acquired the capabilities to produce primary subsystems and components that go into those platforms. Firms can use these internal "vertical" capabilities to their advantage – without consideration for, or despite the superiority of, the capabilities of outside sources.) The Department is evaluating the use of three basic criteria to identify areas of potential vertical integration concern. As it conducts assessments, the Department searches for product or technology areas that are:

- Critical to defense system performance.
- Dependent on significant DoD research and development funding for technological advancement.
- Provided by only a few suppliers, one of which is owned by an original equipment manufacturer.

Domestic source restriction assessments are conducted to determine if those foreign product restrictions contained in the Defense Federal Acquisition Regulation Supplement that were imposed by a DoD policy decision, not by statute, still are required for national security reasons.

Summaries of DoD assessments completed in 1998 follow.

4.2 Industrial Assessments

Report on the Capacitor and Resistor Industry (April 1998)

Section 854 of the 1998 Defense Authorization Act required the Secretary of Defense to conduct a study of the capacitor and resistor industries in the U.S. and the degree of U.S. dependence on foreign sources for resistors and capacitors, and to submit to Congress a report on the results of that study by May 1, 1998. The report was to include an assessment of: (1) the U.S. capacitor and resistor industrial base and a projection of any changes in that base likely to occur after the implementation of relevant tariff reductions required by the December 1996 Information Technology Agreement (ITA); (2) the extent to which the DoD is dependent on foreign sources for its resistors and capacitors and a projection of the level of dependence on foreign sources likely to occur after implementation of relevant tariff reductions required by the ITA; (3) any associated national security implications of the projections reported under (1) and (2); and (4) recommendations for appropriate changes, if any, in defense procurement policies or other Federal policies based on such implications.

DoD performed its assessment primarily using industry information provided by the U.S. International Trade Commission (USITC), and, to a lesser extent, the Electronic Industries Association (EIA), and the U.S. Department of Commerce. The Department found:

- Capacitors and resistors represent mature technologies, available from many U.S. and foreign suppliers. They usually are produced in high volumes and orders generally are awarded to the lowest cost bidder. Applications for DoD account for less than one percent of world capacitor and resistor demand.

- A USITC analysis of tariff reduction impacts conducted in February 1997 concluded that ITA duty elimination likely would result in increased market access opportunities, because of the commodity nature of these products, in the U.S. and European Union. Japan already has eliminated its tariffs on capacitors and resistors; therefore, the ITA will not result in increased market access opportunities there. Representatives of the U.S. Trade Representative advised they will address, during the ITA review process, non-tariff barriers that might restrict access to overseas markets for U.S. exporters of capacitors, resistors, and other products covered by the ITA

- Because of the international nature of the industry, DoD uses resistors and capacitors manufactured by non-U.S. suppliers. However, due to limitations in available data, it is not possible to determine precisely the number of such capacitors and resistors that DoD uses. The majority of capacitors and resistors used in defense applications are procured by lower-tier subcontractors and incorporated into components or subsystems. In response to a query, EIA reported that it was unable to categorize suppliers as domestic or foreign suppliers because of an inability to accurately reflect where the product actually may have been manufactured.

- Foreign-owned firms produce devices in U.S. manufacturing facilities.

- Most large U.S. firms have extensive manufacturing facilities offshore and import the products for sale in the U.S.

- The use of production-sharing facilities, primarily in Mexico, results in individual items with significant percentages of U.S. and non-U.S. content.

- U.S. firms distribute, relabel, and resell products produced by non-U.S. firms.

- National security does not require that capacitors and resistors for DoD applications be supplied by U.S. firms. Current and potential non-U.S. capacitor and resistor suppliers are located in Mexico, Germany, the United Kingdom, the Netherlands, Japan, and other countries in the Pacific Rim. In 1995, DoD eliminated domestic source restriction requirements for these, and other, electronic components to allow DoD to take full advantage of the benefits offered by access to the best global – primarily commercial – suppliers.

The Department made no recommendations to change defense procurement policies or other Federal policies.

Advanced Suspension Systems for Tracked Combat Vehicles (August 1998)

Tracked combat vehicles (TCVs) are ground combat systems. More mobile than wheeled vehicles, they can cross natural and man-made obstacles and urban terrain, in all weather conditions, while under fire. The maximum speed that a combat vehicle can maintain is limited by the power (shock) its occupants can absorb and the need to maintain a stable weapons firing base. Traditional suspension system designs appear to have reached their maximum performance potential. Advanced suspension systems (categorized as passive, adaptive, or active suspension systems) may permit increased vehicle speed over rough terrain. They adjust the rates of energy storage and dissipation in response to the relative motion of the vehicle wheels over which the track moves. This assessment was designed to: (1) evaluate the availability and viability of sources for advanced suspension systems for future TCVs; and (2) identify associated vertical and horizontal competition concerns. The assessment found:

- DoD currently has no requirements for adaptive or active TCV suspension systems. TCVs now being developed will utilize hydro-pneumatic passive suspensions.

- Two of the three current TCV suspension suppliers (General Dynamics Land Systems and Cadillac Gage Textron), plus several U.S. universities and laboratories, are studying adaptive and active suspension systems.

- Several additional U.S. firms and foreign suppliers have the capability to manufacture advanced suspension systems, given a mature design.

- Vertical integration associated with advanced suspension systems is not a concern.

Deformable Mirrors (September 1998)

The atmosphere, temperature variations, and vibration distort optical system images. Deformable mirrors can compensate for these effects in real time. They are used in surveillance optics, laser weapons, and astronomical telescopes. This assessment investigated the availability of current and potential deformable mirror producers, and possible alternative technologies. The assessment found:

- At least three U.S. companies – all operating below capacity – produce deformable mirrors. One of the firms has significantly more experience than the other firms. An additional firm has produced a deformable mirror that now is being tested.

- With the exception of potential increased requirements for Department of Energy applications, demand is expected to grow only slightly over the next ten years.

- Micro Electro-Mechanical Systems (MEMS) technology may provide acceptable alternatives. MEMS-based mirrors powered by electrostatic or magnetostrictive actuators may provide better correction at lower voltages.

DoD will reevaluate the industry when DoD demand increases and the technologies mature.

Fixed-Wing Military Aircraft (September 1998)

This survey was designed to identify at-risk industrial capabilities and vertical and horizontal competition concerns associated with key fixed-wing military aircraft product and technology areas. It reviewed approximately 2000 suppliers in 500 product areas. Consolidation and restructuring patterns among fixed-wing military aircraft suppliers might lead to future competition concerns.

- Recently formed strategic alliances between prime contractors and key suppliers might encourage other suppliers to exit the business.

- Barriers to entry (especially, technological sophistication and environmental compliance requirements) discourage the emergence of new suppliers.

The Department is monitoring developments in key fixed-wing military aircraft product areas to identify and mitigate competitive concerns that may arise.

Large (Strategic and Space) Solid Rocket Motors (September 1998)

Solid rocket motors (SRMs) are used in strategic missiles, tactical missiles, and space launch boosters. U.S. strategic missile production is expected to end in 2008 and not begin again until 2017. This assessment was designed to identify at risk industrial capabilities and vertical and horizontal competition concerns associated with key product and technology areas. The assessment found:

- Strategic missiles and space launch vehicles (including NASA's Space Shuttle) use similar SRMs.

- Strategic missiles, space launch vehicles, and tactical missiles essentially use the same SRM subtier suppliers. Projected combined demand generally will be sufficient to sustain subtier suppliers.

- Three domestic firms design and produce large SRMs suitable for strategic or space launch applications. Two additional firms design and produce smaller SRMs, primarily for tactical missile applications.

- Vertical integration does not appear to be a concern.

- All domestic SRM firms are operating substantially below capacity. Demand for large SRMs is not likely to change appreciably over the next ten years. Demand uncertainties after 2008, make projections difficult. If post-2008 "low end" demand estimates materialize, there likely will be sufficient space launch and tactical missile demand to sustain at least two SRM producers, plus key sub tier suppliers.

- Space launch vehicle and tactical missile production, alone, might not sustain the engineering design capabilities required for next generation strategic SRMs. Additional DoD research and development projects may be necessary to sustain design capabilities and advance performance.

- The lead-time to produce a next generation strategic SRM prototype will be approximately three to seven years

Current strategic SRM production will not end for several years. DoD will continue to monitor the industry, while deferring a decision on what actions to take, if any, to sustain essential engineering and manufacturing capabilities during the upcoming gap in production.

Military Fuzes (December 1998)

Military fuzes have two functions; they initiate warhead detonation when predetermined conditions are met and preclude unintended warhead detonation. This assessment was designed to identify at risk industrial capabilities and vertical and horizontal competition concerns associated with military fuzes. It examined the three categories of military fuzes: (1) target detection devices (very complex devices, primarily used for missiles); (2) electronic fuzes (advanced technologies, used for bombs and some large caliber projectiles); and (3) electro-mechanical fuzes (mature technologies, used for large caliber projectiles). The assessment found:

- For target detection devices:
  - Growing complexity and the need for tight integration with the host system dictate that development be tied closely to the missile system prime contractor. Target detection device suppliers that are not also system prime contractors appear to be leaving the business.
  - Those missile system prime contractors that do not currently produce target detection devices have the capability and motivation to develop and produce such devices for their own missile systems.
  - Selection of future target detection devices probably will not be based on direct competition. Rather, it will be an integral part of the overall missile competition. Vertical integration does not appear to be cause for concern.
- For electronic and electro-mechanical fuzes:
  - In contrast to target detection device procurement practices, DoD generally acquires these fuzes separately from the end item.
  - Reduced demand has resulted in significant consolidation. Of 31 firms producing electronic and electro-mechanical fuzes in 1987, six remain. The remaining suppliers are either small businesses or relatively small units of larger firms.
  - Development competition is limited; two to four suppliers – depending on the type of fuze – have sufficient engineering expertise to develop new fuzes. However, limited development competition does not preclude production competition. Production contracts are not awarded automatically to the development contractor.

- Projected demand may be insufficient to support all six competitors. However, production competition is adequate, even if one or two suppliers leave this sector due to lack of business.

DoD Components are continuing to monitor the military fuze industry, as necessary.

Active Matrix Liquid Crystal Displays for DoD Applications (December 1998)

DoD is monitoring its contractor's efforts to resolve recent problems in active matrix liquid crystal display (AMLCD) supply availability stemming from the decision of Optical Imaging Systems (OIS) to exit the business. AMLCD flat panel displays provide enhanced performance and reliability over current cathode ray tube displays for tactical system cockpits. Flat panel display performance characteristics are critical to situational awareness and "sensor/shooter integration." OIS is a single source subcontractor providing AMLCDs to flat panel display integrators for several programs, including the AH-64 Apache Longbow, M1A2 Abrams digitization, V-22, F/A-18E/F, F-22, and other aircraft programs. OIS ceased operations in September 1998. Flat panel display integrators and system prime contractors are seeking to qualify alternative custom and commercial AMLCD products, and are investigating potential alternative technologies.

Electronic Systems Integration for Weapons Platform Combat Systems (December 1998)

Electronic Systems Integration (ESI) encompasses those tasks required to ensure that a collection of autonomous systems (for example, mission/fire control, sensor, display, communication, and navigation) work together to accomplish mission requirements. This survey focused on ESI, at the platform level, for combat systems. It was designed to evaluate the extent to which industry consolidation has affected ESI vertical competition and innovation. The survey found:

- Prime contractors generally perform ESI for fixed-wing aircraft, rotorcraft, tracked combat vehicles, and satellites. Ship prime contractors generally contract for ESI.

- Prime contractors believe that ESI capabilities are the key to maintaining and expanding their business bases. They use their ESI capabilities to win new development contracts and to guarantee their future in the upgrade market.

- There is considerable evidence of vertical integration within this industry segment (prime contractors generally perform ESI).

- Non-prime contractors generally can meet ESI requirements effectively only if:

  - Platform/ESI interfaces are defined carefully.

- The ESI contractor is responsible for overall combat system performance.
- The ESI contractor controls the software modules.

- It is difficult for new firms to enter the business. Potential ESI contractors must possess expertise in:
  - All phases of combat system development.
  - Integration test facilities and equipment.
  - Operating systems, networking, and computer program languages.
  - Configuration management, system architecture, and design.

Integrated Automatic Flight Control Systems (December 1998)

Integrated automatic flight control systems (IAFCS) permit pilots to control aerodynamically unstable fixed-wing aircraft operating in extreme flight regimes. This assessment was designed to develop a better understanding of the military aircraft IAFCS industrial structure, and identify at risk industrial capabilities and vertical and horizontal competition concerns associated with key product and technology areas. The assessment found:

- Traditionally, prime contractors have subcontracted IAFCS.
- Modern IAFCS increasingly must be integrated with other aircraft subsystems (for example, propulsion and mission avionics systems).
- Few companies have had the core experience and expertise to be IAFCS suppliers. Today, three U.S. suppliers and one foreign supplier provide IAFCS for virtually all DoD fixed-wing aircraft. One of the U.S. IAFCS suppliers also is a prime contractor for military aircraft.
- Aircraft prime contractors have substantial IAFCS design capabilities and are expected to assume an increasing position in the IAFCS industry.
  - Engineering, not manufacturing, capabilities are paramount. Software designs are unique to military aircraft; hardware is not.
  - Fixed-wing aircraft prime contractors with strong electronic systems integration capabilities are poised to enter the market.

- The IAFCS subsystem/supplier base is robust. There are:
  - 34 actuator suppliers.
  - 51 flight electronics suppliers.
  - 37 flight data sensor suppliers.
- Vertical integration is not a concern.

4.3 Domestic Source Restriction Assessments

Both the Congress and the Department have established restrictions on the use of foreign products in defense systems. (DoD's foreign product restrictions were imposed by administrative action, not by statute.) During the Cold War, these restrictions generally were designed to preserve a domestic mobilization base – to maintain the industrial capability required to rapidly produce the defense materiel needed to respond to an attack by the Soviet Union. Today, DoD bases its wartime planning needs on a requirement to fight and win (primarily from existing resources, including already stockpiled materiel) two nearly simultaneous major theater wars. In 1996, the Department examined all foreign product restrictions contained in the Defense Federal Acquisition Regulation Supplement (DFARS) that were imposed as a result of a DoD policy decision. (The Department did not formally evaluate foreign product restrictions imposed by statute.) For each restriction, the Department carefully determined if there were national security reasons or supplier reliability, cost, and quality reasons for retaining the restriction.

During those deliberations, the Department deferred final consideration of one restriction contained in DFARS subpart 225.71 – ship propulsion shaft forgings – because unsettled conditions among domestic suppliers made projections uncertain. In June 1998, the Department completed a new evaluation and concluded that DFARS restrictions for ship propulsion shaft forgings should be retained.

- Nuclear-powered submarine and aircraft carrier ship propulsion shaft forgings must be restricted to U.S. suppliers to preclude disclosing information about U.S. Navy warship performance characteristics and limitations.
- Key U.S. suppliers are in a precarious financial viability position. Absent a DFARS restriction, at least one U.S. supplier could lose sufficient workload to cause it to exit the business.

- If one or more of the key U.S. suppliers were forced to exit, the U.S. Navy: (1) would be faced with significant requalification costs, lead-times, and risks to develop alternate sources, and (2) could be unable to acquire ship propulsion shaft forgings for which foreign suppliers are not acceptable.

5. DoD Component Analyses, Decisions, and Actions

5.1 Introduction

DoD Components frequently conduct their own analyses when: (1) there is an indication that industrial or technological capabilities associated with an industrial sector, subsector, or commodity important to a single DoD Component could be lost; or (2) it is necessary to provide industrial capabilities information to help make specific programmatic decisions. These assessments generally are conducted, reviewed, and acted upon internally within the DoD Components. Summaries of DoD Component analyses completed in 1998 follow.

5.2 Army

120mm Battalion Mortar System High Explosive and Full Range Training Rounds (March 1998)

This assessment was designed to determine if the Army should use other than full and open competition to award a contract for load, assemble, and pack (LAP) for four years of priced options for M934A1 High Explosive (HE) and M931 full range training rounds, at various quantity ranges. The contract also was to include a single option for LAP of replenishment quantities of M933 and M9341 ammunition. There are neither peacetime requirements for M933 rounds nor replenishment requirements for M931 (training) rounds. The estimated value of the basic contract was $22.6 million; the maximum estimated value of the contract if all options are fully executed was $137.1 million. The Army concluded:

- Contract award to a supplier not located in the U.S. or Canada represented an unacceptable national security risk. Production rates required to meet replenishment requirements greatly exceeded peacetime procurement production rates. Under the Defense Priorities and Allocations System (DPAS), U.S. firms can be compelled to meet military requirements by: (1) performing specific defense contracts on a priority basis over other defense or non-defense contracts; and (2) rapidly increasing production to maximum capacity. The U.S. and Canada have entered into a memorandum of understanding in which the Canadian government has agreed to persuade Canadian firms to voluntarily comply with U.S. government requests for such assistance as that statutorily required of U.S. firms under the provisions of the DPAS. Firms located in other countries cannot be so compelled.

- A multiyear contract would establish a long-term relationship with a supplier that will become the Army's "replenishment base." The planned M934A1 acquisition quantities represent only about 3 months of production per year. Adding M931 full range training round quantities (which require identical assemble and pack capabilities, but for which there are no replenishment requirements) reduces the overall cost of the rounds and allows the selected contractor to maintain production for about 9 months per year.

The Army decided to restrict this contract to domestic (U.S./Canadian) sources for mobilization base reasons, as permitted in FAR 6.302-3.

M734A1 Multi-Option Fuzes and M745 Point Detonating Fuzes (April 1998)

This assessment was designed to determine if the Army should use other than full and open competition to award a fiscal year 1998 contract, and four years of priced options, for M734A1 Multi-Option Fuzes – including planned and potential plus-up quantities and options for projected replenishment quantities. The contract also was to include an additional replenishment option for M745 fuzes. The estimated value of the basic contract was $14.8 million; the maximum estimated value of the contract if all options are executed was $247.7 million. The Army concluded:

- Contract award to a supplier not located in the U.S. or Canada represented an unacceptable national security risk. Production rates required to meet replenishment requirements greatly exceeded peacetime procurement production rates. Under the DPAS, U.S. firms can be compelled to meet military requirements by: (1) performing specific defense contracts on a priority basis over other defense or non-defense contracts; and (2) rapidly increasing production to maximum capacity. The U.S. and Canada have entered into a memorandum of understanding in which the Canadian government has agreed to persuade Canadian firms to voluntarily comply with U.S. government requests for such assistance as that statutorily required of U.S. firms under the provisions of the DPAS. Firms located in other countries cannot be so compelled.

- Additionally, technology transfer of the M734A1 proximity sensor electronics design to foreign militaries via foreign manufacturers could lead to the development of countermeasures which would reduce U.S. military effectiveness.

- A multiyear contract would establish a long-term relationship with a supplier that will become the Army's "replenishment base" for these fuzes.

The Army decided to restrict this contract to domestic (U.S./Canadian) sources for mobilization base reasons, as permitted in FAR 6.302-3.

Small Arms Industrial Base Assessment Phase II (April 1998)

Small arms are "manportable" individual and crew-served weapon systems principally used against personnel and lightly armored targets. This assessment focused on the industrial capabilities and suppliers required to produce and maintain the M4 carbine, M16A2 and A4 rifles, M249 squad automatic weapon, M240 machine gun, and MK19 grenade machine gun. The assessment was designed to determine if the U.S. Army should take special actions to

preserve the "small arms production base" (Colt's Manufacturing, Saco Defense, and FN Manufacturing) by sustaining the firms supplying these weapons to DoD. The Army determined:

- DoD does not plan to purchase these weapons after fiscal year 2003. DoD's projected inventories will approach authorized procurement objectives and next generation weapon systems (primarily, the Objective Individual Combat Weapons and Objective Crew Served Weapons now in development) will be nearing production.

- Beyond 2003, Army requirements for these small arms are projected to be limited to maintenance and upgrades. Lack of new DoD small arms purchases may result in one or more of the existing prime contractors exiting the business.

- The current suppliers of small arms were not selected as prime contractors for the next generation weapons. (Alliant Techsystems is the prime contractor for the Objective Individual Combat Weapons program and Primex Technologies is the prime contractor for the Objective Crew Served Weapons program.)

- The three current small arms prime contractors do not possess unique industrial capabilities that must be preserved to meet projected DoD needs.

The Army decided it need not take action to sustain either unique industrial capabilities or the three existing small arms prime contractors. (As required by Section 809 of the *National Defense Authorization Act for Fiscal Year 1999*, the Army is conducting a study to determine if it is necessary for the sake of preserving the small arms production base to restrict future end item and repair part procurements to the three companies comprising that base.)

Depleted Uranium Industrial Base Assessment (August 1998)

DoD uses depleted uranium (DU) penetrators in the 120mm kinetic energy (KE) M829A2 tank round and in the 25mm M919 Bradley round, and expects to use them in the next generation 120mm KE M829E3 tank round. Budget projections suggest there will be a break in 120mm KE tank round production between the time the last M829A2 is scheduled to be produced in April 1999 and the beginning of M829E3 penetrator production, scheduled for February 2003. House of Representatives Committee on Appropriations Report 104-617, dated June 11, 1996, expressed concern that a break in production of 120mm KE tank ammunition could result in a loss of the industrial capabilities required to produce this class of ammunition, when required. The Committee directed the Army to prepare a plan that bridged the production gap. In 1997 and again in 1998, the Army reviewed 120mm KE tank round production capabilities, identified current and projected procurement requirements, and identified and evaluated options to ensure sufficient industrial capabilities are available to meet current and projected requirements as cost-effectively as possible.

- In 1997, the Army projected that the kerf propellant finishing, the composite sabot, and the DU penetrator all were critical to the 120mm program. Therefore, the Army made plans to procure additional M829A2 rounds to bridge the production gap and sustain essential industrial capabilities.

- In 1998 designs for the M829E3 round changed and the Army reevaluated the issues. The Army now projects that:

  - Kerf propellant finishing will not be needed for the M829E3 program.

  - The M829E3 composite sabot likely will utilize a thermoplastic material in lieu of the thermal set material used in the M829A2.

  - The DU penetrator manufacturing capability is the only critical production process that needs to be maintained.

- Planned Army procurements of 25mm M919 rounds for the Bradley Fighting Vehicle System will be sufficient to sustain DU penetrator manufacturing capabilities. There currently are two DU penetrator producers – Aerojet Ordnance of Tennessee (AOT) and Starmet (formerly Nuclear Metals Incorporated). Both AOT and Starmet produce 120mm DU penetrators. AOT also produces M919 DU penetrators; Starmet also produces DU billets used in tank armor production. Only one is necessary to provide sufficient industrial capabilities (including capacity) to meet all current and projected DU requirements.

- After performing a financial viability analysis, the Army concluded:

  - AOT, a wholly owned subsidiary of GenCorp's Aerojet General Division, currently is operating near the break-even point. This is acceptable to its parent firm.

  - Starmet's financial viability could not be determined from the data it made available. However, Starmet asserted it did not need DU penetrator business to remain profitable.

The Army will continue to monitor this situation and is prepared to take action, if necessary, to sustain DU penetrator capabilities.

Fiscal Year 1999 Operations and Maintenance of Lake City Army Ammunition Plant (September 1998)

This assessment was designed to determine if the Army should issue a sole source contract to Olin Winchester Division for the fiscal year 1999 operation and maintenance of Lake City Army Ammunition Plant (LCAAP). LCAAP is a government-owned, contractor-operated

facility that produces small caliber ammunition to meet peacetime and replenishment requirements for all Services. Olin is the current operating contractor. The estimated value of the procurement was $168 million (approximately $152.5 million for the production of ammunition and $15.5 million for maintenance and other activities).

- The proposed procurement was intended to be a bridging mechanism designed to facilitate continued smooth operation of LCAAP in order to meet DoD's fiscal year 1999 small caliber ammunition peacetime procurement requirements and simultaneously maintain required replenishment production capabilities. The Army plans a full and open competition for DoD's fiscal year 2000 and beyond small caliber ammunition requirements.

- Beginning in fiscal year 2000, the Army plans to consolidate its small caliber requirements (peacetime procurement, research and development, replenishment, strategy for the future use/disposition of LCAAP, and any additional requirements) in a single "best value" solicitation. The successful offeror would be permitted to operate and utilize LCAAP to meet those requirements if it wished to do so; however, use of LCAAP would not be mandatory.

The Army decided to issue a sole source contract to Olin Winchester Division for the fiscal year 1999 operation and maintenance of LCAAP, for mobilization base reasons, as permitted in FAR 6.302-3.

1998 Army Industrial Base Assessment (October 1998)

The Army conducted its 1998 Industrial Base Assessment to examine both relevant industry sectors and critical items within the industry sectors. The Army evaluated the extent to which industrial and technological capabilities resident within individual industrial sectors are sufficient to: (1) meet current and projected Army modernization requirements, including transition to the "Army After Next;" (2) permit reductions in planned war reserve inventories for secondary items (ammunition, critical troop support items, and spares), thus freeing up funding for other priorities; (3) provide secondary items in quantities sufficient to support operational plans approved by the Joint Chiefs of Staff; and (4) meet projected post-hostility replenishment requirements. The Army concluded:

- Most sectors have sufficient industrial and technological capabilities to support Army modernization requirements. However, the Army identified concerns in two defense-dependent industrial sectors – ammunition and tracked combat vehicles.

- There is insufficient emergency production capacity to offset war reserve shortfalls and execute operational plans for lithium sulfur dioxide non-rechargeable batteries, and many other secondary items.

- Except for preferred munitions, the industrial sectors generally possess sufficient production capacity to meet Department post-hostility replenishment requirements.

The Army is evaluating risks associated with, and options to address, the identified industrial shortfalls. The Army also is: (1) reviewing sector and subsector definitions to ensure they adequately encompass all relevant industrial and technological capabilities; (2) reviewing evaluation criteria to ensure the criteria cost-effectively address Army requirements; and (3) initiating discussions with the Defense Logistics Agency to identify components, assemblies, sub-sectors, and sectors of mutual interest.

5.3 Navy

Joint Stand-Off Weapon Industrial Base Assessment (September 1998)

The Joint Stand-Off Weapon (JSOW) is an air-to-surface precision guided tactical munition with stand-off and adverse weather capabilities. It employs an inertial navigation system coupled with a global positioning system to improve accuracy. The JSOW prime contractor (Raytheon, formerly Texas Instruments) began low-rate initial production in 1998. The Navy conducted an assessment in 1997 to identify and evaluate manufacturing and component issues that might adversely impact JSOW production. The results of that assessment were summarized in last year's *Annual Industrial Capabilities Report to Congress*. The Navy updated its assessment in 1998. The updated assessment found:

- Raytheon has selected Ametel Corporation to be the sole source supplier of a key integrated circuit used in the JSOW global positioning system. Ametel replaces the original supplier that left the business.

- Schott Glass Technologies is the sole source supplier of Zerodur glass, a critical component for the inertial measurement unit (IMU).

- Kearfott Guidance and Navigation, the IMU supplier, plans to move 85 percent of its JSOW IMU production to Mexico.

- Granaria Holdings B.V. of the Netherlands has acquired Eagle-Picher Industries. Eagle-Picher is a sole source provider of NiH_2 batteries, has a dominant market share in advanced batteries, and is the only supplier qualified to produce special duty cycle thermal and sea water activated batteries for various DoD missile systems – including JSOW. (The Department did not oppose the acquisition. The parties involved have committed to continue to produce products for DoD and have restructured Eagle-Picher to create a limited liability corporation that will perform all classified contracts.)

The program office will continue to monitor developments associated with Schott Glass, Kearfott, and Eagle-Picher to ensure JSOW production is not disrupted.

CH-53E Super Stallion Helicopter Industrial Base Assessment (September 1998)

The Navy purchased one CH-53E in 1998 and plans to purchase one additional CH-53E approximately every other year. The Navy conducted an assessment in 1997 to identify and evaluate manufacturing and component issues that might adversely impact CH-53E production. The results of that assessment were summarized in last year's *Annual Industrial Capabilities Report to Congress*. The Navy updated its assessment in 1998. The updated assessment found that increased foreign sales should offset the impact of reduced DOD procurements, allowing the helicopter prime contractor, suppliers, and vendors to fill production lines and contain CH-53E costs for the next 2-3 years. The Turkish government is purchasing, directly from Sikorsky, 8 CH-53Es; first delivery is scheduled for spring 1999.

Navy and Sikorsky personnel are continuing to monitor materiel lead-times to mitigate impacts on CH-53E production. Navy and Sikorsky personnel also are examining options to identify new suppliers for obsolete discrete electronic components, or emulate the obsolete components with contemporary integrated circuits. Finally, Navy personnel, consistent with DoD policy, are continuing to encourage friendly militaries to replace older H-53 helicopters with new ones.

Taut Mast High Resolution Cathode Ray Tube Industrial Base Assessment (September 1998)

The cathode ray tubes (CRTs) used in fielded high performance aircraft utilize a reinforced (taut) mask behind the front glass of the tube. This taut mask is expensive to produce; manufacture requires specialized equipment and is labor intensive. Taut mask high resolution CRTs represent an older technology and are being replaced gradually by flat panel displays. (DOD demand is limited to that quantity needed to replace CRTs in a variety of fielded military aircraft (for example, the AV-8B, F-14, F-15, F-16, B-52, B-1B, EA-6B, E-2C, P-3C.) The F/A-18E/F, F-22, and Joint Strike Fighter will utilize flat panel displays in lieu of CRTs.) Planar Inc. is the sole producer of taut mask high resolution CRTs. In 1997, the Navy evaluated concerns that low DOD requirements for such CRTs provide insufficient incentive for the sole source producer to continue production. The results of that assessment were summarized in last year's *Annual Industrial Capabilities Report to Congress*. In 1998, the Navy completed deliberations on the issue and awarded Planar a two-year contract for sufficient CRTs to meet all projected DoD requirements.

5.4 Air Force

Joint Programmable Fuze Industrial Capability Assessment (March 1998)

The Air Force and the Navy are developing the Joint Programmable Fuze (JPF) for the Joint Direct Attack Munitions program. The JPF is an electronic fuze designed to be highly reliable while providing multiple arming times, instantaneous and multiple short and long delay detonation times, hard target survivability, cockpit programmability, and increased service/shelf life. It will be compatible with the MK-80 series and BLU-100 series guided and unguided bombs. The JPF will replace or supplement the FMU-139, FMU-143, FMU-124, and M904/M905 fuzes. This assessment was designed to determine if industrial capabilities were sufficient to meet planned JPF research and procurement requirements.

- Motorola Corporation's Tactical Systems Operation (TSO) was the JPF engineering and manufacturing development contractor. TSO focused on relatively low volume, high technology fuzes for bombs and missiles. TSO announced it planned to exit the business; it would exhaust its existing fuze backlog and not pursue any additional fuze business that would extend its backlog past 1999.

- Alliant Techsystems (which had focused on high volume, medium technology artillery fuzes) acquired TSO's conventional fuze business for approximately $12 million in December 1997. Motorola agreed to sell to Alliant the intellectual property technical data and equipment necessary to produce the conventional fuzes for which TSO had development or production contracts. Motorola also agreed to:

  - Facilitate Alliant recruitment of those TSO employees with technical expertise that could ensure the success of the newly purchased business.

  - Provide technology transfer support via an exclusive services contract.

  - Allow Alliant employees to assist TSO employees in final production builds.

- Alliant plans to consolidate the TSO operations with its Defense Systems Group fuze production operations in Hopkins, MN and Janesville, WI.

- Several remaining firms (Alliant, KDI Precision Products, and Raymond Engineering) are capable of designing, developing, and producing electronic fuzes. Two other firms (Bulova Technologies and Dayron) are capable of producing electronic fuzes.

Despite TSO's exit from the conventional fuze business, there are sufficient industrial capabilities available to meet DoD's electronic fuze requirements. Historically, fuze production contracts are not awarded automatically to the development contractor. (In January 1998, Dayron won the first JPF production contract.)

Analysis of Commercial Aircraft Suppliers and Impact of Current Bottlenecks on Defense Procurements (July 1998)

Boeing's efforts to rapidly increase commercial aircraft production between 1997 and 1998 resulted in problems both for the company and its suppliers – critical parts shortages, sub-optimal labor allocations, late deliveries, and reduced profits. This assessment was designed in two phases. Phase I identified and evaluated factors that impacted Boeing's efforts to boost commercial aircraft production rates. Phase I is complete.

In Phase II, the Air Force will evaluate the impact such practices could have on DoD aircraft programs as they move from development to production. The Air Force plans to apply the knowledge gained from studying issues associated with rapidly increasing commercial aircraft production, to defense aircraft; and report on these "lessons learned" at a later date.

Parts for Unplanned Depot Repair (July 1998)

Scheduling labor and material to support aircraft programmed depot maintenance within a government maintenance facility is based on accomplishing a defined set of tasks, in sequence. As an aging aircraft undergoes planned maintenance, inspectors and technicians frequently identify unexpected problems such as hidden corrosion, cracks due to structural fatigue, or obsolete components that need to be replaced. Such problems generate unplanned work requiring immediate attention – often extending the repair cycle due to the limited availability of the parts required for that unplanned work. These delays reduce aircraft availability and increase costs. This assessment evaluated depot management processes designed to minimize delays in obtaining the parts and material required for unplanned depot aircraft repair. The Air Force:

- Evaluated processes associated with operational evaluation and inspection of the aircraft during depot repair, supportability planning and engineering, assessing material availability, rapid transmittal of material requirements, and synchronization of material delivery. Existing processes did not adequately address the need to meet planned schedule requirements when faced with additional, unplanned, work.

- Hypothesized a just-in-time parts replenishment process to decrease or eliminate delays caused by unplanned requirements. Based on the hypothesis, analysts modeled and evaluated the process, and identified improvements.

- Developed, and integrated into its formal programmed depot maintenance procedures, a corporate Air Force model to minimize schedule disruptions caused by unplanned work.

The Air Force Material Command approved the consolidated model in August 1998. Warner Robbins Air Logistics Center is implementing the model in its C-130 depot repair area.

Diminishing Manufacturing Sources and Obsolescence in a Mature Fighter Aircraft: F-15 AN/APG-63/70 Radar System (August 1998)

This assessment was designed as a case study to evaluate obsolescence in the F-15 radar system and the program office's responses to that problem. The Air Force chose the F-15, rather than an aircraft still under development because: (1) the F-15 aircraft represented a stable environment for analysis; (2) the APG-63 and the newer APG-70 radars represented two similar systems at different levels of technological maturity; (3) the Air Force program office was upgrading the APG-63; and (4) the Air Force had substantial information on F-15 radar obsolescence. These circumstances allowed the analysts to evaluate various management strategies to minimize obsolescence. The study addressed both the current method of determining repairable inventory level and inventory policy. The Air Force found:

- Parts obsolescence is a significant problem. Of those parts unique to the APG-63 radar, 37 percent (572 parts used a total of 8,712 times) have no known manufacturer.

- Utilizing more recent technologies does not necessarily reduce the risk of parts obsolescence. Although the older APG-63 radar contained a higher absolute number of obsolete parts, the newer APG-70 radar exhibited an increased rate of parts obsolescence.

- Attempts early in a system's life cycle to reduce the impact of obsolete parts, primarily by acquiring increased quantities of spares, have not been effective. Each obsolete part likely will impact several line replaceable units, shop repairable units, and components.

- Database information on diminishing manufacturing sources and material shortages can be used to predict "mean times for parts availability." Existing database information proved useful in predicting a mean time for parts availability of 6.0 years for the upgraded APG-63 radar.

The assessment provided insight for program managers on tracking, predicting, and responding to obsolescence in military systems. The Air Force is using the results of the assessment to improve its command-wide process addressing diminishing manufacturing sources and material shortages, and to strengthen corporate DoD processes.

5.5 Defense Logistics Agency (DLA)

Tray Pack Ration Readiness Investment Follow-on (January 1998)

Tray pack rations are a member of the family of DoD Operational Rations. They are used to sustain groups of military personnel in highly mobile field situations. The component items are thermally processed, shelf-stable foods, packaged in hermetically sealed half-seam, table-size metal containers. DoD contingency requirements for tray pack rations greatly exceed peacetime

requirements. In this assessment, DLA reevaluated issues previously addressed in May 1996. DLA compared current tray pack ration industrial capabilities to those required to meet contingency requirements.

- Peacetime production quantities are insufficient to justify continuous production of tray pack can bodies and lids. Prime and subtier suppliers produce only periodically for peacetime requirements.

- The availability of tray pack cans and lids in the early stages of a contingency is one of the limiting factors in increasing production to meet contingency requirements.

- DLA determined that, in order to meet projected tray pack ration wartime requirements, it should pre-stock tray pack cans and improve selected production processes.

In fiscal year 1998, DLA awarded a tray pack firm a $2.9 million contract to acquire 1.8 million tray pack cans to offset 60-90 day component lead-times. DLA also upgraded key sterilization production equipment (retorts) furnished as Government Furnished Equipment to further reduce lead-times. Finally, DLA awarded key firms a manufacturing technology contract to improve production efficiency by developing special racks to protect the trays during the retort process.

Aircraft Launch and Recovery Equipment (February 1998)

Arresting systems are central to aircraft carrier landing operations. As the aircraft lands, its tailhook catches an arresting cable. Sheaves (pulleys) transfer the tension to aircraft arresting system machinery below deck, which safely stops the aircraft. The Naval Inventory Control Point determined that, to meet wartime requirements, sheave production rates would have to be increased quickly by a factor of two.

DLA found that peacetime production capabilities were not sufficient to meet contingency requirements. The average sheave production lead-time was 343 days, primarily because of the time required to obtain forgings. Since the contractor already was operating at maximum capacity, DLA determined the most cost-effective solution would be to "preposition" completed forgings with the contractor.

In fiscal year 1998, DLA awarded Saturn Industries a $306,467 contract to produce and preposition forgings sufficient to meet projected sheaves wartime requirements within 33 days.

Chemical Protective Suit Liner Fabric Follow-on (February 1998)

The Battle Dress Overgarment (BDO) chemical-protective ensemble is out of production and is being replaced by the Joint Services Lightweight Integrated Suit Technology (JSLIST)

ensemble. DoD is replacing BDO war reserve inventories with JSLIST ensembles as BDO shelf lives expire. In 1998, DoD acquired approximately 167,000 JSLIST suits. Four manufacturing facilities, three of which are controlled by the National Industries for the Severely Handicapped (NISH), produce JSLIST suits. (As required by the Javits, Wagner, O'Day Act, the Department awarded NISH 109,000 JSLIST suits in 1998 and expects to award the same amount in 1999). Von Blucher GmbH, a German firm, owns the patent for the JSLIST suit liner fabric; it has not established a license agreement with a domestic producer. Our North Atlantic Treaty Organization allies use the same suit liner technology for their chemical protective suits. DLA conducted an assessment to determine if current production capabilities are adequate to meet planned sustainment requirements.

The assessment concluded that Von Blucher has sufficient production capacity to meet planned post-conflict replenishment requirements, but would require four months to acquire the raw material needed to produce fabric liner in excess of peacetime requirements. Therefore, absent a "readiness bubble" of fabric liner stored within the continental U.S., DoD would be unable to immediately surge and sustain production above peacetime levels. Quantified surge requirements will be evaluated and developed as the JSLIST suits replace BDOs in the war reserve inventory and the Services identify inventory shortfalls.

DLA awarded a series of liner fabric contracts to Von Blucher GmbH, through its wholly owned U.S. selling agent, Tex Shield. In February 1998, DLA exercised a $2.43 million contract option for liner fabric. DLA now has a liner fabric reserve of 185,000 yards, enough to produce in excess of 56,000 JSLIST suits. The contract also provides for fabric storage, currently in Maine, in close proximity to two of the four manufacturing facilities. DLA is developing a mechanism to rotate the liner fabric reserves into JSLIST production pipelines, ensuring reserve fabric is used before shelf lives expire. Finally, the Department is seeking substitute technologies that can be inserted into the JSLIST suit to alleviate any production capacity risks associated with the sole source liner fabric supplier. However, because of testing requirements, certification of any such technologies could not occur before April 1999.

Meal, Ready-to-Eat Equipment/Maintenance Follow-on (February 1998)

The Meal, Ready-to-Eat (MRE) is DoD's "go to war" operational ration; it is designed to provide individual meals to troops in austere environments. The actual MRE has virtually no commercial counterpart, since commercial products do not meet stringent military nutrient, shelf life, and packaging requirements. DLA conducted this assessment to: (1) reevaluate previous decisions to maintain Government Furnished Equipment (GFE) to augment MRE industry production capability for meal bags (which contain individual entrees and accessories); and (2) ensure the GFE is placed where DoD would derive maximum production capability. The GFE (valued at $2.5 million) consists of one assembled and one unassembled MRE meal bag manufacturing line purchased to meet readiness requirements. The assembled line is installed at Cadillac Products, Inc. DLA purchased the unassembled manufacturing line to meet projected Operation Desert Storm requirements that did not materialize.

DLA concluded that DoD should continue to provide the assembled GFE manufacturing line to Cadillac Products to augment industry production capacity to meet projected operational requirements. DLA awarded Cadillac Products a $42,000 follow-on contract to store and maintain a single meal bag line machine. The contract expires September 30, 2000. DLA removed "critical components" from the unassembled equipment and is allowing Cadillac Products to use those components as a source of spare parts for the assembled GFE manufacturing line. DLA is taking steps to dispose of the remaining portions of the unassembled manufacturing equipment.

Heavy Expanded Mobility Tactical Truck Components Follow-On (March 1998)

In August 1996, DLA conducted an assessment to determine if industrial capabilities were sufficient to meet Heavy Expanded Mobility Tactical Truck (HEMTT) filter element peacetime and contingency production requirements. In 1997, DLA, in consultation with representatives of the Army's Tank-Automotive and Armament Command, examined additional HEMTT critical components. (For assessment purposes, critical components were defined to be those war reserve items subject to high peacetime and wartime demand and with relatively long delivery lead-times.) This assessment concluded that delivery lead-times for the critical components averaged 120 days, too long to meet surge production requirements. Therefore, DLA awarded contracts totaling $437,000 to Oshkosh, Prestolite, Hader, BMK Manufacturing, and International Filter to maintain a rotational stock of critical components. This action reduced component lead-times from 120 days to 3 days, sufficient to meet contingency operations requirements.

DLA reevaluated this decision in fiscal year 1998 and concluded that additional critical components needed to be prepositioned and rotated. DLA awarded new contracts totaling $125,369 to Oshkosh, Parker Hannifin, and Rockford Power Train to maintain a rotational stock of these components.

Short Shelf Life Pharmaceuticals (March 1998)

Short Shelf Life Pharmaceuticals (SSLPs) are drugs (for example, antibiotics for battle injuries, vaccines for disease prevention, and analgesics for pain relief) that lose their potency and strength after a scientifically predetermined timeframe. Drug shelf life can range from less than 6 months to greater than 2 years. DLA conducted this assessment to determine if the pharmaceutical industry could meet DoD's SSLP surge and sustainment requirements. The assessment concluded:

- The Services have large requirements for many medical items, especially in the early phases (0-60 days) of a contingency. The normal production lead-time for most medical stock items is 120 days.

- DLA has "Distribution and Pricing Agreement" contracts for over 24,000 pharmaceutical items; it has readiness requirements for approximately 1,400 of these items – produced or distributed by almost 400 firms.

- The industrial base is capable of meeting DoD's surge and sustainment requirements for about 72 percent of these 1,400 items.

DLA uses stock rotation contracts to purchase a specified inventory quantity that will remain with the manufacturer and be rotated as part of the manufacturer's drug inventory. The inventory then is available to quickly meet Department contingency and wartime requirements. Stock rotation contracts enable DLA to meet large initial demands in a cost-effective manner and avoid losses due to shelf life expiration of items in storage. In 1998, DLA awarded two additional SSLP stock rotation contracts with an inventory value of approximately $175,000. The contracts have a 5-year base period and an option for an additional 5 years.

Chemical Protective Gloves (April 1998)

Chemical protective gloves are an integral part of the chemical protective ensemble used to protect troops from chemical and biological weapons attack. This assessment reevaluated issues previously addressed in April 1996 and April 1997. It was designed to determine if essential industrial capabilities would be lost in the absence of DoD peacetime procurements. DLA concluded:

- These gloves are military-unique. Butyl rubber is the only known material capable of meeting all Service requirements for protection against chemical and biological agents. The butyl rubber solvent dipping process used to produce the gloves requires unique manufacturing processes and hazardous material recovery equipment. The necessary specialized equipment, and requirements for special licenses from the Occupational Safety and Health Administration and the Environmental Protection Agency, discourage entry of new sources.

- Two companies, North Hand Protection and Guardian Manufacturing, have the equipment and licenses required to manufacture butyl chemical protective gloves. Under the terms of an Industrial Base Maintenance Contract (IBMC), each is required to ensure it has sufficient production capacity to meet planned replenishment requirements. (Absent the IBMCs, peacetime production would provide insufficient incentive for the contractors to retain protective glove industrial capabilities. The IBMCs ensure the industrial capabilities are preserved; however, they do not sustain sufficient surge production capacity to overcome inventory shortfalls.)

- The gloves have a shelf life of 15 years; extended from 5 years as the result of a shelf life extension program. Even with these extensions, the Department expects significant Service inventory attrition during the next 2 - 3 years.

- The Department had anticipated that the Joint Services Lightweight Integrated Suit Technology (JSLIST) Program would introduce a new generation glove in 1997. However, the new protective gloves did not meet requirements for military pilots. The 7-mil butyl glove in current use still is required.

- DoD has begun a protective glove pre-planned product improvement program to develop and qualify gloves capable of meeting all requirements. The first new glove was delivered for testing in October 1997. Preliminary indications are that these gloves could be produced on the same production lines being sustained under the IBMC. Testing is expected to extend into April 1999. It is unlikely that a new product could be fielded before 2000.

In April 1998, DLA awarded 1-year IBMCs totaling $3.955 million to North Hand Protection and Guardian Manufacturing. Each contract contains two 1-year options to sustain industrial capabilities until DoD determines if the new gloves are satisfactory. Each 1-year option also contains a provision requiring the firms to produce protective gloves at a minimum sustaining rate to facilitate potential surge production to overcome inventory shortfalls.

Sutures (June 1998)

DoD uses sutures to close cuts, incisions, and lacerations stemming from surgery or trauma. Meeting DoD's wartime requirements for sutures presents significant challenges. Sutures in use today may be obsolete 6 months later. Standardization is difficult because numerous companies make sutures of various sizes and with differing features. DLA found:

- Suture manufacturers do not have enough material on hand to support wartime sustainment requirements for day 41 and beyond.

- It is extremely difficult to determine what types of sutures actually are being produced, stored, and sold to meet commercial demand. This lack of commercial manufacturer product line and production capability information hinders DoD's ability to prepare for projected operational scenarios.

In August 1998, DLA awarded Johnson and Johnson's Ethicon Division a $2 million Corporate Exigency Contract establishing a long-term partnership to: (1) obtain manufacturing data regarding what currently is being produced; and (2) provide sutures to meet projected sustainment requirements.

MRE Packaging Industry Follow-on (August 1998)

Packaging is a critical element of the MRE. It is designed specifically to meet requirements for durability in transit, storage, and field use; to withstand adverse climatic conditions; to survive airdrops; to resist nuclear, biological, insect, and vermin infestation; and to meet a 3-year shelf life requirement. The "Berry Amendment" requires DoD to purchase food grown or produced within the U.S. The requirement has been enacted in permanent legislation [Section 9005 of Public law 102-396, As Amended (10 U.S.C. section 2241 Note)]. Consequently, only domestic sources have been used for MREs, including MRE packaging materials. Packaging materials for MREs are the pacing items that determine the MRE industry's ability to surge production. DLA evaluated MRE packagers in November 1997. DLA conducted this follow-on assessment to consider the impact of updated MRE operational requirements.

- Projections of the total number of MREs required to meet DoD's wartime requirements for MREs are unchanged. However, current plans require more MREs to be available, earlier. DoD now projects MRE availability shortfalls in the first 75 days of a conflict.

- Commercial manufacturers laminate and convert rollstock material into military-unique MRE preformed pouches for individual entrees. The ability to detect packaging/pouch defects prior to contractor product delivery is critical. Currently, approximately 6 percent of MRE pouches have defects. If the contractor identifies one failure during post-acceptance inspections, the entire lot is placed on hold and is subject to 100 percent contractor reinspection. The subsequent delays impact the overall delivery of MREs to the warfighter.

- Multi-Unit Leak Detectors (MULDs) automatically test pouches and detect production damage in the vendors' assembly line. MULDs virtually can eliminate the "latent" package defects in accepted lots and facilitate an uninterrupted stream of MRE deliveries to the customer.

In fiscal year 1998, DLA completed a purchase of six MULDs (two units for each of the three MRE suppliers) for a total of $1.779 million.

Camouflaged Bandages (September 1998)

DoD uses camouflaged bandages to treat wounds inflicted in the field. These bandages not only are used individually, they also are used as components for various assemblies. Camouflaged bandages are military-unique. Camouflaged bandages require dedicated production equipment because the dye used in a field dressing contaminates machinery. Only "dyed" bandages can be manufactured on the equipment, not the "white" bandages used by the commercial sector. DoD has been unable to persuade commercial bandage manufacturers to

produce camouflaged bandages because of DoD's small peacetime requirements compared to the commercial bandage market.

As required by the Javits, Wagner, O'Day Act, the Department must award contracts for thirteen types of camouflaged bandages to a National Industries for the Severely Handicapped (NISH) contractor, Elwyn Industries.

- The Department has identified contingency military operational requirements for six of the thirteen types of bandages that Elwyn Industries supplies. Elwyn Industries has significant difficulties meeting normal peacetime requirements; Elwyn cannot meet DoD's contingency requirements.

  - Elwyn's workforce has significant mental and physical limitations and has difficulties adjusting to increased demand.

  - DoD projects it would require approximately 4.9 million of these bandages in the first 120 days of a conflict. Due to long lead-times in obtaining necessary materials, Elwyn's production capacity during this timeframe virtually is zero. (The lead-time for raw materials is 12 weeks.)

- Elwyn could significantly boost production by adding a second and third shift. However, since Elwyn would require about 12 – 20 weeks to add such shifts, the surge production impact would be minimal.

In August 1998, DLA invested $1.37 million to preposition long lead-time raw materials at Elwyn's production facility to facilitate accelerated bandage production. DLA also is looking into the feasibility of: (1) purchasing additional production equipment to expand Elwyn's production capability; (2) gaining NISH approval to establish a second source with Federal Prison Industries Incorporated; and/or (3) establishing a second source with another NISH supplier.

Nerve Agent Antidotes in Autoinjectors Follow-on (September 1998)

Nerve Agent Antidotes (NAAs) in autoinjectors are military-unique items designed for rapid self-administration through clothing upon exposure to nerve agents. DoD uses two styles of autoinjectors – Atropine and Combopen. Both are front-end activation injection devices. Atropine style autoinjectors use a stainless steel cartridge to inject atropine. Combopen style autoinjectors use a tempered glass cartridge to inject Pralidoxine Chloride or Diazepam. The Army uses Atropine and Pralidoxine Chloride autoinjectors packaged together in "Mark I" Kits. The U.S. Food and Drug Administration (FDA) must approve the antidotes, autoinjectors, and manufacturing processes. DLA previously evaluated NAAs in autoinjectors in 1997 to determine if there were sufficient industrial capabilities to meet DoD requirements. In fiscal year

1998, DLA reevaluated that issue and expanded its investigation into the subtier level. DLA concluded:

- Although peacetime requirements are low, NAAs in autoinjectors must be available quickly, in large quantities, in the event of a military contingency. Peacetime requirements are insufficient to sustain a source of supply.

- Title 10 U.S.C. section 2534 restricts the purchase of chemical weapons antidotes contained in automatic injectors or components for such injectors, to those manufactured in the U.S. and Canada.

- Quantities required to meet mobilization requirements greatly exceed peacetime needs.

- Meridian Medical Technologies (MMT) (formerly Survival Technology Inc.), a domestic firm, is the only FDA-approved manufacturer of NAA autoinjectors. In addition to producing the autoinjectors, MMT also assembles the Mark I Kit.

- DLA has helped offset the impact of MMT's 4-month production lead-times by purchasing and prepositioning needed components, significantly reducing the time required to accelerate production.

- Twenty-nine firms make up MMT's supplier base. Fifteen of these companies are sole source manufacturers for component parts for either the Atropine or Combopen injectors. There is a moderate, yet acceptable, risk that these firms may be unable to meet DoD's accelerated production requirements.

- There are no viable second source candidates. Significant barriers to entry (including extremely limited peacetime demand, significant initial investment, and a time-consuming FDA approval process) discourage potential new suppliers.

DLA awarded MMT an IBMC in October 1995 to maintain production capabilities for autoinjectors. In November 1997, DLA exercised its second and final 1-year option for that contract. In 1998, DLA purchased, and is storing, $3 million worth of components for Morphine, Atropine, and Pralidoxine autoinjectors. (Diazepam purchases were unnecessary.) DLA also is considering a follow-on contract.

Tents (September 1998)

Tents and tent liners are critical when mobilizing troops. In fiscal years 1997 and 1998, DoD's annual peacetime procurements for new tent production decreased to about one-third of previous levels. The Services drew down inventories and focused on developing next generation products. Suppliers dependent on DoD business reacted predictably. One firm reduced its workforce by dismissing all of its defense tentage-related employees and retreated to other

business areas; a second closed completely. The seven firms remaining depend solely on military business. Several of these firms may be forced to exit the business. DoD needs to be able to draw on the production capacities of all of the remaining firms to meet projected surge requirements. Once lost, the capabilities and capacities needed to meet DoD's tentage requirements would take about one year to reconstitute.

DLA developed an acquisition strategy to sustain six of the seven companies producing tents for DoD applications. DLA: (1) apportioned projected peacetime purchases among six of the companies; and (2) issued a $468,000 contract to the seventh supplier designed to assure it retained the level of workload required to sustain needed production capacities.

6. *Related Activities*

6.1 Industrial Capabilities Improvement Activities

In addition to performing industrial capabilities analyses, several DoD programs and/or activities specifically seek to develop or improve industrial capabilities.

Title III of the Defense Production Act

The Defense Production Act (DPA) (50 U.S.C. App. 2061 *et seq.*) is the primary legislation designed to ensure that the industrial resources and critical technology items essential for national defense are available when needed. Title III of the DPA provides a vehicle to establish, modernize, or expand domestic production capability and capacity for technology items, components, and industrial resources that are essential for national defense provided: (1) either no domestic capacity exists or (2) the domestic capacity that does exist is insufficient to meet defense needs. Under the authorities of Title III, DoD can provide domestic firms with a variety of financial incentives to reduce the risks associated with establishing the needed capacity; including purchases or purchase commitments, loans and loan guarantees, and the purchase or lease of advanced manufacturing equipment which can be installed in government or privately owned facilities. DoD uses purchases and purchase commitments most frequently. (The Department is submitting a separate report to Congress on the Title III program.)

The Department organizes and executes its Title III program as a DoD-wide program, generally focusing on materials and components that can be used in a broad spectrum of defense systems. The Office of the Secretary of Defense provides top-level management, direction, and oversight. The Air Force executes approved and funded projects for the Department. In 1998, the Department began one new Title III project, initiated development of two others, and completed another.

Power Semiconductor Switching Devices (PSSDs)

PSSDs are solid-state devices that can be used to replace conventional electro-mechanical switches in medium and high-power electrical applications. They provide increased efficiency, reliability, and power handling capability, and also reduce acquisition and life-cycle costs in both military and commercial applications. This project seeks to improve PSSD quality, performance, reliability, availability, and affordability. The $12.0 million project ($2.3 million of which is being provided by the contractor) is scheduled to be completed in late 2003.

Silicon-on-Insulator (SOI) Wafers

SOI substrates can significantly improve the performance of low power and/or radiation tolerant integrated circuits used in defense systems. This project will establish domestic sources for SOI wafers (up to eight inches in diameter) that have emerged from research and development but which require lower-cost, higher-volume production capabilities before they

can be inserted affordably into DoD systems. The project is designed to provide sufficient incentives to create a domestic SOI wafer production capacity of 1.4 million square inches per year. The project will cost approximately $7 million over a three-year period.

Silicon Carbide (SiC) Substrates

This project will establish a viable, world-class domestic manufacturing capability for 75mm diameter SiC semiconductor substrates. The project is designed to increase affordability and quality by improving boule and wafer manufacturing processes. The project will cost approximately $7 million and will include a contractor cost-sharing requirement.

Semi-Insulating Gallium Arsenide (GaAs) Wafers

GaAs, an electronic substrate material, is an enabling technology for a wide variety of defense and commercial applications; it is used in communications systems, in radar systems, in smart weapons, and in electronic warfare systems. The Department began the GaAs project in March 1994 and completed it successfully in March 1998. Before the Title III project, the domestic GaAs industry was on the verge of collapse, threatening DoD's access to this essential material. Now, the three contractors that participated in the project form the core of an economically viable, highly competitive U.S. presence in the worldwide GaAs marketplace. They are providing affordable world-class GaAs materials for both defense and commercial applications. Collectively, the three companies have more than tripled their sales and increased their global market share from 24 percent to 59 percent. DoD invested $23.1 million in the Title III project and the contractors added capital investments exceeding $15 million. Though the project has ended, the contractors plan additional investments to improve production capabilities further.

Dual Use Science & Technology Program

DoD initiated the Dual Use Science & Technology (DU S&T) program in fiscal year 1997 to increase the insertion of dual use technologies into defense systems. (A dual use technology is a technology that has both military utility and sufficient commercial potential to support a viable industrial base. Such "dual use" permits DoD to take advantage of the same competitive pressures and market-driven efficiencies that have led to accelerated development and savings in the commercial sector.)

The program jointly funds research projects with industry that develop dual use technology solutions for DoD problems. In fiscal years 1997 and 1998, DoD began a total of 163 projects and distributed over $130 million of DU S&T funds to the Military Services. The Services augmented this investment with additional Service and industry funding such that the overall investment for these projects has totaled $563 million. In 1998, DU S&T projects emphasized eight focus areas.

Affordable Sensor Technology

DoD is partnering with commercial industry to tap into advances in commercial sensors and jointly fund the development of sensor hardware, software, and system architectures needed to meet both the future needs of the military and commercial markets.

Aircraft Sustainment

Both the military and commercial aircraft industries need to improve readiness and extend the life of their aging fleets.

Distributed Mission Training

DoD is partnering with commercial firms to develop simulated training capabilities that will allow multiple trainees at multiple sites to utilize complex, scalable, and tailorable synthetic training equipment.

Fuel Efficiency and Advanced Propulsion Technology

Both military and commercial customers desire propulsion systems that provide increased power, safely; and reduce costs.

Information Systems and Technology

The advent of the information revolution has increased significantly the need to exchange, manage, manipulate, and protect large amounts of essential information. Tools that can alleviate "information overload" are invaluable both on the battlefield and in the boardroom.

Medical Technologies

This program will speed up development and commercialization of new technology breakthroughs to simplify and dramatically improve the prevention, diagnosis, and treatment of injuries.

Advanced High Speed Vessels and Structural Systems for Large Sea-Based Structures

This program supports the development of high performance and affordable sea-based platforms. It focuses on technologies associated with high-speed vessels, structural health monitoring systems, and reliable composite structures.

Environmental Monitoring

Accurate, real-time, meteorological and oceanographic forecasts facilitate effective planning and decision-making. Technologies of particular interest include: (1) miniaturized sensor design; (2) sensor deployment by unmanned aerial and undersea vehicles; (3) optimization

methods for sensor placement and reporting; (4) real time communication and processing of sensor data for a regional area; (5) prediction of changing environmental assessment requirements; and (6) optimum data assimilation methods for reducing uncertainty in environmental analyses.

DoD Manufacturing Technology Program

DoD's Manufacturing Technology (ManTech) Program addresses defense-critical manufacturing processes that impact affordability and the ultimate success of weapon system programs. In the weapons system design phase, the ManTech Program focuses on assuring the design facilitates low variability manufacture and on maturing needed process capabilities to acceptable risk levels. In the production phase, ManTech emphasizes low-cost, high quality manufacture; efficient factory operations and supplier interactions; and the decoupling of unit cost from production volume. In the support and sustainment phase, the program concentrates on efficient repair processes; rapid, low-cost spares and replacement parts acquisition; and efficient maintenance and repair operations.

In response to the requirements of 10 U.S.C. section 2525(e), the Department issued its first annual Five-year Plan for the ManTech Program[1] on February 12, 1998. The Plan:

- Describes the ManTech Program's goals, priorities, and investment strategy.
- Presents Military Service and Defense Logistics Agency ManTech Program funding for fiscal year 1998, and planned funding for fiscal years 1999 through 2003.
- Describes the ManTech Program's six technical subareas and subarea-specific objectives, expected payoffs, challenges to be overcome, milestones and evaluation metrics, and roadmaps.
- Summarizes program measures of effectiveness and the results of internal and independent reviews.

Flat Panel Display Assessment

Senate Report 105-29 of the *National Defense Authorization Act for Fiscal Year 1998* directed the Under Secretary of Defense for Acquisition and Technology to evaluate requirements and test data related to the performance of custom and ruggedized commercial flat panel displays in military applications. Additionally, the report language required that the study assess life cycle costs and support issues such as commonality, supportability, interface standards, open systems architectures, and availability. Study results were to be used in acquisition tradeoff decisions intended to meet user needs at the lowest life cycle cost.

[1] The plan is available on the internet (http://mantech.iitri.com/pubs/pubs.shtml).

In March 1998, the Department submitted *The Acquisition of Flat Panel Displays for Military Applications* to the Senate Armed Services Committee. The Department determined:

- Few programs or contractors explicitly performed tradeoff analyses of life cycle cost and performance when acquiring flat panel displays.

- Appropriately ruggedized consumer-grade flat panel displays can meet the environmental and performance requirements of a broad range of military applications (including shipboard, command and control, Army ground vehicles, military transport aviation, and soldier-portable computer systems).

- Currently, ruggedized consumer-grade flat panel displays cannot meet the specifications for some highly stressful applications, particularly tactical aircraft cockpit avionics.

- For some applications, DoD currently is dependent on foreign flat panel display suppliers, but this dependency does not raise immediate foreign vulnerability issues.

- DoD could face serious supply problems if domestic custom flat panel display suppliers exit the business.

- Few display integrators employ an open systems architecture approach, despite the potentially significant life cycle benefits of open systems.

- DoD would benefit by:

  - Improving DoD cross-Service and cross-program coordination.

  - Developing military display roadmaps.

  - Promoting life cycle affordability in flat panel display decision making.

  - Adopting an integrated process team acquisition approach addressing mission planning, technology development, operational experiments, cost analysis, and training.

  - Assuring long-term supplier availability.

  - Increasing the use of open systems architectures, making possible increased benefits from standardization and commonality.

The Department has established a joint industry-DoD working group to address these issues.

DoD Technology Transfer Program

The Department established the Office of Technology Transition within the Office of the Secretary of Defense to serve as a focal point for DoD's domestic technology transfer activities. Specifically, this office: (1) monitors DoD research and development activities and identifies those technological advances that have potential for non-defense commercial applications; (2) serves as a clearinghouse for, and coordinates and facilitates the transfer of, such technological advances to the private sector; (3) coordinates its activities with the Departments of Energy and Commerce; and (4) provides private firms with assistance in resolving legal issues related to technology transfer.

The Office of Technology Transition maintains a website[2] providing information on technology partnership business opportunities, success stories, and links to DoD laboratories where the technology transfer activities take place. Each DoD laboratory has established a specific point of contact – an Office of Research and Technology Applications – to assist industry representatives in transferring federally developed technology that has potential commercial applications. Additionally, both the Navy (1-800-NAVYTECH) and Air Force (1-800-203-6451) have established toll free telephone lines that can be used to request assistance.

Improving the Army's Diminishing Manufacturing Sources and Material Shortages Program

The Army's Diminishing Manufacturing Sources and Material Shortages (DMSMS) program is part of a DOD-wide program to identify, control, and mitigate obsolescence issues within DOD. The program focuses on items and material needed to repair, build, overhaul, and/or support Army systems. It is designed to mitigate risks associated with production items, supply and sustainment items, and/or related materials that are, or are becoming, obsolete as production for that item or material ceases. In 1998, the Army identified several weaknesses in its program and decided to:

- Increase visibility by formally establishing Army DMSMS policies and guidance, forming a DMSMS working group to monitor and coordinate Army activities, and developing and funding an integrated DMSMS program budget.

- Develop an integrated data base management system to identify, notify, and monitor DMSMS cases; and use that integrated information system to:

  - Develop a team relationship with program managers, integration managers, and personnel managing obsolescence resolution programs.

[2] (http://www.dtic.mil/techtransit/)

- Improve communications with other Services, organizations, industry trade associations, and academia.

The new Army DMSMS integrated information system electronically connects Headquarters Army Materiel Command with its major subordinate commands and automatically consolidates all obsolescence alerts issued through the Government Industry Data Exchange Program (GIDEP) into a single system. The new system then screens each notification item against existing databases to identify the end item(s) that use the part. Once the end items are identified, Army DMSMS personnel distribute the obsolescence information to the appropriate Army program or item managers for resolution. Finally, the system documents solutions and automatically distributes that information (via GIDEP) to all government agencies.

6.2 Commercial Technology Insertion

The Department also identifies, adapts, and leverages predominantly commercial and dual use capabilities and products.

The Commercial Operations and Support Savings Initiative (COSSI)

The COSSI program adapts and inserts commercial items into fielded defense systems to reduce operations and support (O&S) costs. COSSI takes advantage of the advances and investments being made by commercial firms in areas like computers, software, electronics, and advanced materials. In addition to financial savings, COSSI projects tend to improve the performance of military systems by providing an upgrade path to the very latest technology. The agreement type used for COSSI projects is an *Other Transaction for Prototypes*. This acquisition method mirrors commercial market practices. It encourages non-traditional suppliers to provide DoD with innovative products and technologies. It also requires commercial firms to share in the costs associated with adapting and testing commercial components for use in a military system. Cost sharing and partnering with industry allow DoD to leverage a commercial firm's technology investments to reduce O&S costs and improve the performance of fielded defense systems. If adaptation, as demonstrated by qualification testing, is successful, COSSI projects proceed into production under traditional Federal Acquisition Regulation contracting methods.

For example, one COSSI project leverages composite rotor blade technology developed for a civil helicopter for use on the UH-60. Because the commercial contractor invested 7 years and $17 million developing the blade for the civil helicopter, the UH-60 Program Office will receive a fully tested and qualified rotor blade within two years, for about $4.5 million. UH-60 Program Office exposure is limited to defining and executing a qualification program (demonstrating technical, safety, supportability, and maintainability requirements are met) that ensures the new blade is suitable for fleet implementation. The Army would have had to spend $26 million to develop, demonstrate, and field a new UH-60 rotor system using traditional

acquisition means (based on the contractor's initial investment and share of adaptation/qualification costs, plus the Army's share of adaptation/qualification costs).

In fiscal year 1997, DoD invested approximately $100 million in 30 COSSI projects; commercial firms contributed an almost equal amount. The Department estimates O&S cost savings to be generated by these 30 COSSI projects at approximately $3 billion over 10 years.

- Composite rotor and blades for the Apache helicopter
- Composite 12-ton semi-trailer van
- Eyesafe laser rangefinder for the OH-58 helicopter
- Computer replacement for the Guardrail Sensor System
- Night vision heads-up displays
- Polymeric serving container for operational rations
- Satellite tracking system for materiel
- Advanced flight control computer for the UH-60 helicopter
- Composite main rotor blade for the UH-60 helicopter
- Low cost computer encryption card
- Ultrasonic testing of pressure vessels aboard ships
- Reconfigurable electronic modules for the AN/SPS-67 radar
- Lithium ion batteries for underwater vehicles
- Portable engine test cell for the H-53 helicopter
- Communications gateway for intelligence systems interoperability
- Integrated system management tools for software
- Integrated usage and monitoring system for the H-53 helicopter
- Light weight aircraft battery
- Laser cladding process for corrosion resistance
- Commercial hardware and open system software for the AN/BQR-22 system
- Information transfer using "push" software
- Inspection kit for composite propeller blades
- Commercially based processing for F/A-18C/D avionics
- Data capture and analysis system for shipboard logistics
- VME standard components for the MILSTAR antenna positioning control unit
- Discontinuous reinforced aluminum sheet for the F-16
- Commercially based processing for F-15 avionics
- VME standard bus for the mini-mutes system
- Data distribution kits for mobile command centers
- Exhaust nozzle for the F110 engine

DoD has funded the fiscal year 1999 program at $57 million and expects to select new projects in March 1999.

Leveraging Commercial Communications Satellite Technology and Investments to Meet Defense Needs

By leveraging commercial investment and emerging capabilities to replace or augment military satellite communications systems, DoD can maintain an affordable leading-edge communications infrastructure while focusing its technology development funding in areas that provide a distinct military advantage. This report, completed in December 1998:

- Describes the benefits of using commercial communications satellite systems, technologies, and services.
- Identifies specific opportunities to augment military satellite capabilities.
- Recommends DoD actions to leverage commercial investments:
  - Improve interoperability and affordability through adherence to commercial standards and participation with commercial industry in the development of protocols.
  - Meet military requirements such as flexibility, capacity, and security by modifying commercially-procured equipment.
  - Take advantage of near-term opportunities to increase ultra high frequency bandwidth within the current DoD communications satellite architecture.
  - Work with commercial industry – both domestic and foreign – to expand the supplier base for satellite components and allow defense integrators to focus on technology areas not currently commercially competitive.
- Assesses key technology and manufacturing issues associated with exploiting opportunities in the tactical communications area and on related technology and industrial base concerns.

DoD is assessing these opportunities and has made significant progress in specific areas.

6.3 Executive Agents and Working Groups

DoD sometimes has limited visibility into industrial issues associated with custom components (non-commercial items or subsystems) used in multiple defense applications. Generally, development and procurement of such components are decentralized. Major system contractors and subcontractors, program offices within each Military Service and

the Defense Logistics Agency, and even civilian agencies, all can play significant roles. In two such cases, DoD established corporate mechanisms to better monitor the industrial and technological infrastructure providing these components and coordinate DoD's own activities.

Microwave Power Tubes

Microwave power tubes are used to generate and amplify microwave energy – a form of electromagnetic radiation. DoD uses microwave tubes such as klystrons, traveling wave tubes, and crossed field amplifiers in land, sea, air and space applications, in radar systems, electronic warfare systems, and in telecommunications systems. The Department of Energy (DOE) uses large, high-power klystrons to power particle accelerators used for high-energy physics, nuclear physics, and materials science research. The DoD, with DOE participation, analyzed the effects of declining expenditures for microwave tubes on its programs, in 1997. The results of the assessment were summarized in last year's *Annual Industrial Capabilities Report to Congress*. The study concluded that, although the industry had restructured in response to reduced defense spending, the downsizing trend had not affected the industry to the extent that direct DoD intervention would be required to maintain national security. However, DoD also concluded that changing circumstances could impact DoD's ability to meet all of its microwave power tube requirements. In May 1997, DoD designated the Navy as its Executive Agent to: (1) identify and maintain consolidated DoD microwave power tube acquisition requirements and research and development plans; (2) monitor the major domestic microwave power tube manufacturers and key component and material suppliers; and (3) facilitate coordination among the Services and Defense Agencies, and among DoD and other U.S. Government Agencies that use microwave power tubes.

The Navy is executing its responsibilities. The Executive Agent:

- Has appointed Product Area Focus Group (PAFG) leaders to serve as focal points for issues peculiar to each major microwave power tube type.

- Convenes regularly scheduled videoconferences of PAFG leaders and industry representatives to exchange information and discuss issues.

- Developed a database to monitor DoD's microwave power tubes. The database includes about 95 percent of active military systems and about 97 percent of all DoD system microwave power tube "sockets." The database enables the PAFG leaders to establish normal usage rates and identify unacceptable failure trends.

- Maintains liaison with DoD research organizations and routinely consults on the efficacy of proposed projects.

- When requested, provides expert opinion on export control issues concerning DoD microwave power tubes and responds to congressional inquiries.

The Executive Agent is addressing and/or monitoring several areas of concern:

- Microwave power tube manufacturers have indicated that their most pressing concern is obtaining a reliable supply of various critical materials (beryllium oxide silicon, rare earth magnets, "vacuum quality" core iron, cupronickel, monel, and tungsten). Lack of uniform specifications, requirements for varying sizes and tolerances, and small quantity orders further complicate the problem. DoD is considering establishing projects under the provisions of Title III of the Defense Production Act to address these concerns.

- The 1997 assessment concluded that projected DoD technology development funding was adequate both to sustain required capabilities and to meet emerging DoD product technology requirements. *However, current research and development funding has been reduced by 33 percent from those projected levels.* This cutback is slowing efforts in computer-aided design and modeling, development of new/alternate materials, and in the important growth area of millimeter wave technology. The Executive Agent is evaluating strategies to address these shortcomings.

- Efforts to privatize Thomson Thermo-Electriques (TTE) may affect the willingness of that company to provide long term support to DoD users. TTE is the most significant and proficient manufacturer of microwave power tubes in Europe. It also is the single source supplier of critical millimeter wave power tubes for several DoD applications – MilStar (Military Satellite and User Equipment), NESP (Navy Extremely High Frequency Satellite Program), and the PAC-3 (Patriot Advanced Capability) Missile Upgrade. U.S. firms generally were unable or unwilling to develop the required microwave power tubes, citing insufficient research and development support during design and development.

- Communications and Power Industries, Inc. (CPII) – one of the largest and most technologically advanced U.S. suppliers – has been offered for sale. A future owner could make a business decision to no longer manufacture critical microwave power tubes for DoD applications. CPII is the only qualified supplier of more than 15 percent of all DoD microwave power tubes and the preferred supplier for an additional 17 percent. For example, CPII is the only supplier of critical power tubes in the AEGIS MK99 Fire Control System. The Navy attempted to qualify a second source for these microwave power tubes on several occasions, but the efforts proved unsuccessful and were abandoned.[3]

[3] In December 1998, CPII representatives announced that attempts to sell the firm were being terminated because potential buyers were experiencing difficulties obtaining financing during a period of uncertainty in the high yield debt market.

Radiation Hardened Microelectronics

Radiation *hardened* microelectronics are designed to withstand the deleterious effects of extremely high radiation levels that might occur as the result of a nuclear weapon burst. Conversely, radiation *tolerant* microelectronics are able to withstand the effects of naturally occurring radiation such as that found in space but would fail or malfunction if subjected to nuclear weapon burst radiation levels. DoD satellites and missiles are required to function in more severe radiation rate and dose level environments than commercial satellites and launch vehicles. In 1996, the Department conducted an assessment to determine if there are and will be sufficient industrial capabilities – technology, engineering, manufacturing, and test – to meet projected DoD radiation hardened microcircuit requirements. The results of the assessment were summarized in the February 1997 *Annual Industrial Capabilities Report to Congress.*

In May 1997, the Under Secretary of Defense (Acquisition and Technology) formally directed that DoD:

- Implement a radiation hardened microcircuit research and development investment strategy (at between $60 million and $70 million, annually) to focus required technology and new product development activities.

- Establish a corporate management approach, the Radiation Hardened Oversight Council (RHOC), to oversee implementation.

- Explore a graduate initiative to bolster core expertise within government and industry.

The Department established working groups to monitor both production capabilities and industry's ability to advance technology to meet DoD needs:

- Two key suppliers of digital radiation hardened microcircuits (Honeywell and Lockheed Martin) have committed to purchase new capital equipment to produce next generation devices, once DoD-funded research and development advances the state of the art. However, in July 1998, Raytheon/Hughes, which previously had indicated it would advance its product line and produce radiation hardened microcircuits for the open market, announced instead that it would close its radiation hardened microcircuit facility. This closure will affect systems that require radiation hardened electronics that work at cryogenic temperatures (for example, the Space-Based Infrared System (SBIRS), Low).

- In August 1998, a working group determined that the technology gap between the performance of radiation hardened microcircuits and that of commercial state-of-

the-art devices continues to grow even though future DoD systems increasingly will utilize advanced radiation hardened electronics. To survive, suppliers will have to make radiation hardened products attractive to both military and commercial space system builders by providing products that approximate commercial product performance. Shortfalls in research and development funding are impacting DoD's ability to meet this objective. The Department has programmed increased corporate Science and Technology radiation hardened microcircuit investments through fiscal year 2002; however, program offices have not yet increased their research and development funding, commensurately. RHOC working groups are developing a mechanism to achieve the required research and development funding levels. Such a funding profile will advance the technology and simultaneously sustain required industrial capabilities.

- DoD also is addressing the issue of radiation *tolerant* devices by undertaking two initiatives dealing with production of radiation tolerant materials and devices for use in both military and commercial applications.

  - A Defense Production Act, Title III project (see *Silicon-on-Insulator Wafers* in Section 6.1) that will address production capabilities and capacities for wafer substrate material.

  - A Dual Use Science and Technology Program project to develop a large volume commercial electronics fabrication line capable of producing radiation tolerant parts, at a significantly reduced cost, on the same production line used for conventional electronic components.

7. Conclusions

Section 2504 of title 10 of the United States Code, establishes Congressional policy designed to ensure the national industrial and technological base will continue to be able to meet the Nation's national security requirements. The Department has established policies and procedures, performed analyses, and taken the actions necessary to:

- Leverage the capabilities and competitive pressures of the commercial marketplace.
- Identify and evaluate those industrial and technological capabilities needed to meet current and future defense requirements.
- When necessary, determine the most cost- and mission-effective actions that the Department should take to preserve endangered essential capabilities.
- Respond appropriately within the Department's regular budget, acquisition, and logistics processes.

In 1998, the Department and its Components continued to break down barriers between the commercial and defense industries in order to meet mission requirements cost-effectively. The Department and its Components also performed sector, subsector, commodity, and product assessments to: (1) identify the key capabilities required for a particular product; (2) profile potential suppliers that possess those capabilities, and (3) determine the extent to which demand estimates might influence the continued availability of those capabilities. Recently, DoD industrial assessments also considered the extent to which vertical integration (or the use of "preferred" suppliers) within a consolidated defense industry might adversely affect competition and innovation.

The Department is taking those steps necessary to identify and address potential industrial capabilities problems wherever they occur; and DoD Component program offices are monitoring industrial and technological developments affecting individual programs, and taking appropriate action to mitigate program risk.